

BLINDNESS IN NORTHERN NIGERIA.

By

F.H. Budden

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BLINDNESS IN NORTHERN NIGERIA

REPORT ON AN INVESTIGATION CARRIED OUT IN NOVEMBER-DECEMBER 1974
AS A WHO SHORT-TERM CONSULTANT

by

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Purpose of visit

1. To collect information on the prevalence and causes of blindness in northern Nigeria:
 - (a) collect data already available in the literature;
 - (b) contact local sources of information;
 - (c) carry out an assessment or survey in parts of the region.
2. The data thus obtained to be used to identify priorities and to formulate a programme for specific action to be taken, due consideration being given to available facilities and other existing priorities.

Description of work undertaken

Consultations were held with officials in the Federal Ministry of Health, Lagos, and in the State Ministries of Health in Kaduna, Jos, Maiduguri and Kano. I met members of the Ahmadu Bello University (ABU) Medical Faculty but unfortunately Professor I. S. Bhar, in charge of the Guinness Ophthalmic Unit, was on leave. The ophthalmologists working in Kaduna, Jos, Maiduguri and Kano showed me their units and discussed the blinding diseases they encountered. I was also able to discuss blinding diseases of childhood with paediatric staff at ABU and doctors at Garkida and Wusasa Hospitals. I met Dr W. Gregory, a VSO entomologist, working in the Hawal Valley on simulum assessment.

Data extracted from previous relevant publications are given in Appendix I.

Surveys conducted during the visit are reported in Appendix II.

Estimate of prevalence and causes of blindness¹

Prevalence of blindness

Allowing for the different standards of blindness employed in the past, there is broad agreement as to the prevalence of blindness in northern Nigeria.

¹ For references not given in the text, see Appendix I.

Trachoma and blinding corneal lesions become more common as one travels towards the northern border. Blindness rates which are probably less than 0.5% near the southern border reach about 1.5% near the northern border.

Where moderate endemic onchocerciasis is superimposed, higher rates are found and in heavy endemic areas rates reach 5.6% and even higher in individual villages.

It seems reasonable to estimate the overall blindness rate at about 1% of the population.

The number of blind persons in northern Nigeria

There is no accepted recent census of population. An estimate provided by the Ministry of Health, Lagos, shows a population of 51.38 million in 1973. This suggests that there are now approximately half a million blind persons in northern Nigeria. Of these some 350 000 are of working age.

The economic importance of blindness

The cost of supporting some 350 000 people is a considerable economic burden.

The main causes of blindness are

Trachoma. If, as seems likely, our findings in Garki District are typical of the northern border of Nigeria then there is a serious trachoma problem in this area. The onset is usually in childhood and in most adults the disease is burnt out. Blindness is due to corneal lesions, usually associated with trichiasis. Trachoma is causing far greater morbidity than indicated by the prevalence of blindness for in many children and adults there is marked photophobia, discomfort and disability without actual blindness. It was noticeable that patients who could count fingers in the shade were unable to do so when their eyes were exposed to bright light and, although not recorded as blind, many of these patients would have found it impossible to work normally in bright sunlight.

The problem becomes less serious as one travels south and at previous surveys I found a particularly low prevalence on the Bauchi Plateau.

"Senile" cataract. Although of senile type, onset is at an earlier age than in Europe. In the present surveys the age distribution of eyes blind due to cataract was: 25 eyes in the 40-49 year age-group, 29 eyes in the 50-59 year age-group, 28 eyes in the 60-69 year age-group and 28 eyes in the 70+ year age-group. These eyes were already technically blind and many had developed hypermature cataracts with secondary uveitis and glaucoma. Thus the onset of cataract commonly precedes senility and frequently causes blindness in persons of working age. A rough calculation suggests that it may be the cause of blindness in between 150 000 and 200 000 persons, about half of whom are of working age.

The combination of a high prevalence of cataract and onset at an early age also occurs in Pakistan and India.

I was a little surprised to find "senile" cataract a more common cause of blindness than trachoma in the present surveys. This was not my finding nor that of other workers at previous surveys near the northern border. One would like to think that improved water supplies and hygiene are responsible.

Another indication of the effect of public health measures is the complete absence in young children of the scarred and phthisical eyes associated with smallpox scars which are seen in adults. The last case of smallpox was reported in 1969.

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Xerophthalmia. Leucomata often with adherent iris, anterior staphylomata and phthisis bulbi commonly originate in childhood. It is often impossible to diagnose the cause when presented with the blind patient decades later. However, there is strong circumstantial evidence that xerophthalmia is responsible for many cases:

1. Dietary studies¹ suggest that there is a lack of vitamin A in the diet of the indigenous northern Nigerian. One would expect this to be more marked towards the northern border as one travels further from the source of red palm oil. There is also a lack of first class animal protein and kwashiorkor is known to be common in children. A weaning diet of pap is commonly used without supplements.
2. Thomson (1956) thought vitamin A deficiency an important cause of blindness in Kankiya District and Rodger (1959) also believed it to be important, accounting for 5% of blindness in northern Nigeria.
3. Dr Maureen Duggan, Senior Lecturer in paediatrics at ABU University, Zaria told me that active corneal lesions were frequently seen in their unit, that the children were usually malnourished and that there was a history of measles in at least half the cases. During my short visit I saw three children suffering from malnutrition and active corneal and conjunctival lesions typical of xerophthalmia (a child of eight years in Wusasa Hospital, Zaria; a child of three years in Dantuttu Village; and a child of five years in Garkida Hospital). There was no history of measles in the patients I saw and no epidemic of measles at the time.

To sum up, there is as yet no proof, but there is in my opinion little doubt, that as in South-East Asia, the combination of protein calorie malnutrition with vitamin A deficiency is common in northern Nigerian children and that consequent xerophthalmia is an important cause of blindness. Measles and probably other fevers may worsen the child's malnutrition to the extent of producing corneal lesions.

These lesions are more important than the prevalence found at surveys suggests, partly because the onset of blindness is usually in early childhood and, therefore, more important both from an economic and humanitarian angle, and also because there is good evidence that many of the children blinded do not survive the initial illness and if they do are handicapped to such an extent that they are liable to die at an earlier age than their peers.

Onchocerciasis. This is an important cause of blindness in those foci with moderate or heavy endemicity. The distribution had previously been mapped (Budden, 1956). I was not told of any additional foci having subsequently been found.

Moreover I found that onchocerciasis was the cause of blindness in 2% of 1076 blind persons examined in non-endemic areas (these were migrants from endemic areas). At that time I estimated that in northern Nigeria 20 000 persons were blind due to onchocerciasis. The number may have since increased with the increase in population.

Where the disease is heavily endemic, as in the Hawal Valley, it is of serious economic importance. The evacuation of villages previously reported has now been studied in detail by Andrew Bradley.² Many of these villages are in fertile valleys which might be intensively farmed if onchocerciasis were eradicated.

Primary glaucoma. The onset is at an earlier age than in Europe. Dr Olurin found it to be the cause of blindness in 20.7% of 1000 consecutive blind patients at Ibadan and Mr J. D. Scott reported it to be an important cause of blindness in the Enugu area.

¹ Nicol, B. M. (1949) Nutrition of Nigerian peasant farmers, with special reference to the effects of vitamin A and riboflavin deficiency, British Journal of Nutrition, 3, 25-43.

² Bradley, A. K. (1972) The effect of disease on rural economy, social structure and settlement. A case study of onchocerciasis in the Hawal Valley, Nigeria (Unpublished WHO document WHO/ONCHO/72.93).

3/11/77 Letter Request

The present situation regarding eye care

Primary education is expanding rapidly, it now reaches 30% of children and universal primary education is planned by 1980. The majority of the population (70%) live in villages, where most adults are still illiterate and will be for some decades. They are unaware of the nature of the eye diseases that afflict them and do not realise that most blindness can be effectively prevented or cured by simple measures.

Rural health centres and dispensaries, which should provide primary eye care, are increasing in numbers but are as yet too sparsely distributed and their staff are not sufficiently mobile to provide day to day advice and treatment for the entire population. The staff probably now receive a sound basic training in eyes. This is certainly true of those trained at the Medical Auxiliary Training School in Kaduna. However, when working in the field, rural dispensary staff often lack technical and administrative support and regular supervision by doctors.

Medical officers generally are fully occupied in their base hospitals and find little time to spend in dispensaries. When one considers the size of the country and the number of ophthalmologists it is not surprising that a visit from an ophthalmologist is extremely rare. There is normally no established procedure for the regular referral of problem cases to an ophthalmologist. Drugs are supplied through local administrations who, I am told, are seriously short of funds.

The average medical practitioner's knowledge of ophthalmology is limited. This is not a serious matter in countries with well developed ophthalmic services and limited eye disease, but in northern Nigeria the prevalence of eye disease is high and ophthalmologists are few. Thus general medical officers in peripheral hospitals where there is no ophthalmologist are unable to provide the expert eye care needed.

There has been a remarkable expansion in the number of ophthalmologists working in northern Nigeria during the 15 years since Independence. There are now about 15 ophthalmologists working in the states comprising the northern region compared with the three in 1959. However, even now the ratio is about 1 per 4 million population compared with 1 per 50 000 in Britain where there is far less eye disease.

Perhaps the most encouraging development has been that of the Guinness Eye Unit under the direction of Professor I. S. Bhar. This is now not only a well known clinical centre to which patients travel from a very wide area, but also an undergraduate teaching centre, integrated with the ABU Medical School.

Another very effective unit is the Sudan Interior Mission Eye Hospital in Kano. This has been established some 35 years. In round figures there are 200 beds and the two American ophthalmologists deal with 4000 cataracts, 3000 entropions and 700 cases of glaucoma each year. However, the Mission Hospital does no work in the villages, their patients are fee-paying and drawn from a wide area, 30% from the south of Nigeria. It is of interest that in Garki District less than 100 miles from Kano, I saw 21 patients blind from cataract, but only two patients who had had surgery.

Although an appreciable proportion of hospital patients come from rural areas, the number of rural patients treated makes little impression on total morbidity in the villages.

The trend towards the development of sophisticated hospital services appears to have affected rural work adversely and ophthalmology is no exception. There is no longer a rural ophthalmic team working under the day to day supervision of an ophthalmologist and, with the exception of the work being done by Dr Kohli from Kano City Hospital, I found no ophthalmologist making regular visits to rural areas in the states I visited.

Ophthalmic equipment and ophthalmic beds are unevenly distributed. There is a shortage of equipment and beds in many hospitals dealing with large numbers of eye patients whereas excellent specialized equipment is available in another unit which deals with relatively few eye patients.

RECOMMENDATIONS AIMED AT REDUCING BLINDNESS

A. Recommendations regarding specific diseases

1. TRACHOMA

Transmission of the disease could be eliminated by improved hygiene but this will require fundamental changes in behaviour of the population and is essentially a long-term objective. In the meantime, prevention of blindness is urgent in areas near the northern border and mass control measures suited to the local conditions should not be delayed. When the number of active cases has been substantially reduced in these areas, selective treatment may be introduced. Later selective treatment may be extended to areas further south where mass treatment may not be necessary.

Plans have been agreed for universal primary education and for rapid expansion of primary health care. These developments should be fully exploited so that the population becomes aware of the disease and enthusiastic for its control.

The following measures are, therefore, recommended.

1. A pilot project of mass treatment in an area near the northern border. The project must be designed to work in a rural district with rudimentary health services and should be suited to the needs of a population at present largely ignorant and apathetic about the disease. However, the local administration is usually enlightened and strong. The district head should be convinced of the value of the project and his enthusiastic cooperation ensured before work commences.

Garki District where an administrative structure, base buildings and good public relations have been established for malaria control, but where malaria work is being phased out, might be a suitable area for the initial campaign.

The project must at first develop its own resources for simple health education, propaganda and delivery of treatment; at the same time encouraging cooperation from local administrative staff, dispensary staff and educational staff (both primary and Koranic school teachers).

Treatment should follow accepted WHO recommendations,¹ e.g. twice daily application of tetracycline suspension eye drops for six consecutive days every month for six months. The results should be properly evaluated as recommended by WHO.

Staff. Northern Nigeria is fortunate in having the services of a WHO consultant, Dr H. Rössler, who is experienced in trachoma control. I hope that he will plan and direct the project and be assisted by a local ophthalmologist or medical officer with an interest in developing trachoma control and in eventually taking over command of the programme.

An administrative officer will be required to arrange transport, delivery of drugs, payment of staff, liaison with native administration, education department, etc.

Lay field workers locally recruited will be required to make day to day application of drugs if treatment is to reach a large population. Care must be taken in choosing the right people and the choice may well depend on local availability. Several suggestions were

¹ Field methods for the control of trachoma, WHO, 1973.

made to me, i.e. (a) primary and Koranic school teachers working in the evenings - however, it may well be that their time and energies should be fully committed to the campaign for universal primary education; (b) "malams" such as those employed for the adult literacy campaigns some years ago; (c) ward heads. I was given conflicting advice as to whether these staff should be paid or not. My own opinion is that an adequate monetary incentive would be necessary to ensure an efficient service.

Medical auxiliaries should be seconded to work on the campaign. They would be trained by and work under the supervision of the ophthalmologist(s). Initially they would themselves administer day to day treatment, later they would train the lay personnel to take over treatment and finally they would assume a supervisory role, making spot checks to ensure that treatment is regularly and effectively applied. Some auxiliaries might remain with the unit on a permanent basis and take over day to day running of a mass treatment unit as the work expands. Others would return to general duties in areas where trachoma was a serious problem having acquired a knowledge of its control.

Transport. Efficient and adequate transport is essential. In some areas rural tracks may have to be improved to allow access to remote villages.

2. Prevalence surveys. Once the pilot project of mass treatment is established and working smoothly the ophthalmologist should commence sample surveys to establish the prevalence of trachoma in other areas with a view to planning.
 3. Gradual extension of mass treatment to all areas of high endemicity. This would be achieved by creating new mass treatment units under the day to day management of administrative officers and medical auxiliaries but supervised by an ophthalmologist.
 4. Case finding and selective treatment. The campaign of mass treatment should be followed up by a team of medical auxiliaries working with an ophthalmologist. They would select cases requiring further medical or surgical treatment (for trichiasis) and give this. It should prove possible to train suitable medical auxiliaries not only to select cases but also to carry out a standard surgical procedure for trichiasis. This team would work in close cooperation with local hospitals, rural health centres and dispensaries. Their activities might eventually be extended to areas further south where mass treatment would not be necessary but where selection and treatment of individual sufferers was desirable. Once a team of medical auxiliaries was well trained it might work without the day to day supervision of the ophthalmologist who would then be released to train another team, but would still visit the first team.
 5. Development of trachoma care in general hospitals, rural health centres and dispensaries. This work might be fostered in the following ways:
 - (a) close liaison and interchange of staff between members of the trachoma unit and their opposite numbers working in institutions;
 - (b) training of personnel in management of trachoma;
 - (c) making tetracycline drops or ointment freely available in all institutions so that a bottle or tube is always given to any patient requiring treatment - not just a single drop or squeeze of ointment.
- Eventually one would hope to see the maintenance of trachoma control taken over by these units and transmission of the disease gradually interrupted.
6. Education. To ensure the long-term success of this programme it must be accompanied by a campaign of education aimed at:

- (a) arousing public interest;
- (b) teaching the simple hygiene necessary to interrupt transmission;
- (c) explaining control measures;
- (d) training staff in management and control.

The cooperation of the Education Department, educational publishers, the media and institutions training school teachers, medical auxiliaries, nurses and doctors should be elicited.

7. Postgraduate medical education and research. From the outset close liaison and cooperation should be established between ABU and the trachoma control unit. Secondment of university staff to work with the unit for research projects and postgraduate training should be encouraged.

2. "SENILE" CATARACT

This is the only common cause of blindness which can be cured and using modern surgical techniques the risks of surgery are very small. It is a measure of the limited impact of ophthalmic surgery on the rural population that I saw 110 eyes blind from "senile" cataract and only six eyes which had had surgery. Amongst village people there is a fear of eye surgery and particularly of travelling to a city hospital and the costs involved.

There are two possible ways in which the situation might be improved:

1. A diagnostic team from a base hospital visiting villages and screening for surgical cases (cataract, early glaucoma and trichiasis) could select cases and transport patients to the base hospital for surgery. In Malumfashi and Garki I found an average of 16 blind cataract patients per day. I am confident that once the value of surgery was appreciated in the villages larger numbers would present. The work done by the Royal Commonwealth Society for the Blind at Enugu is a model for this type of enterprise.

2. Cataract "camps" might be based on peripheral hospitals, rural dispensaries or schools during vacations. These have worked successfully in northern India and Pakistan. They might be staffed by local ophthalmic surgeons assisted by voluntary short-term ophthalmic surgeons from Europe and America. Supporting administrative staff, nursing staff and medical auxiliaries would be required.

Whichever method is used a high standard of surgical technique should be maintained. It is probable that the method employing a shuttle service to a base hospital is the more likely to succeed in the first instance but that once the success of surgery is widely appreciated cataract camps may be required to meet the demand.

3. ONCHOCERCIASIS

A disease causing blindness in over 5% of the population living in a fertile valley is a matter for serious concern. Onchocerciasis has caused understandable public disquiet and strong political pressure is being exerted for its relief. This contrasts with a comparative lack of interest in other causes of blindness which are more widespread and more common but cause less concentrated misery.

The best hope of controlling the disease lies in the treatment with insecticides of all simulium breeding sites over a wide area. A very high level of vector control must be obtained in order to interrupt transmission. Small-scale projects such as those previously conducted at Abuja and Kainji are bound to fail.¹ Before the work can commence, simulium habits must be studied and breeding sites accurately mapped over a very wide area.

¹ Unpublished WHO document OCP/73.1 - Onchocerciasis control in the Volta River Basin area, p. 43.

In the meantime, and even after transmission has been interrupted, individual patients threatened with serious ocular lesions may benefit from nodulectomy and/or drug therapy.

It has been intimated that in some five years, when the first results of the Volta River scheme have been assessed, an application from Nigeria for an extension of the control scheme to its territory might be favourably considered. Well planned entomological control cannot be initiated until the preliminary survey work is done. Even if this preliminary assessment is pushed ahead with energy it will take several years to complete.

One can be assured of strong public support for any control or therapeutic measures but the temptation to initiate ill-advised schemes because of the political pressure for quick action must be resisted in the best interests of the population afflicted. The following measures are advocated.

1. Entomological study of endemic areas to provide the detailed background information required before simulum control can begin. This will be referred to as simulum assessment. The distribution of endemic onchocerciasis (Budden, 1956 - see Appendix I) and simulum breeding¹ in northern Nigeria has been published. Figures drawn from Budden's paper indicate that about 1500 miles of main river run through the endemic foci. The study and mapping of simulum breeding in those rivers and their tributaries is a very large task. Dr Gregory quoted a suggestion that one entomologist can maintain surveillance over 100 miles of river by traditional means. There is no prospect of obtaining the services of 15 entomologists in the near future. However, the Volta River Scheme is using aircraft to survey rivers and only employing five entomologists.

Administration. Simulum breeding rivers cross State and National boundaries. Clearly simulum assessment should be administered as a Nigerian Federal Project rather than as individual State projects. Close liaison with the Volta River project should be established from the outset so that techniques and records are comparable. This will facilitate possible involvement of the Volta River team in the subsequent control programme.

Onchocerciasis is a medical problem and the project should be closely linked to the Federal Ministry of Health if not under its direct control. The research aspect of the work should also establish links with ABU University and if possible with research institutions overseas. It was suggested to me that the work might be combined with that of the National Institute for Trypanosomiasis Research. This might allow some administrative economies and is worth considering but I am not convinced that these would outweigh the advantages of an independent unit.

2. Medical and surgical treatment of patients threatened by serious visual loss. There is evidence that an adequate course of suramin, possibly preceded by banocide, effectively destroys adult worms of *O. volvulus* and may reduce the risk of serious ocular lesions developing in patients threatened with these. However, the treatment is dangerous, and serious, sometimes fatal reactions have been reported. These reactions are probably due to release of toxins from the worms in heavily infected and susceptible patients rather than to the drug itself.

A case can be made for the administration of suramin to individual patients carefully assessed by an ophthalmologist, provided the patients are under medical supervision during treatment and for some weeks after treatment is completed. Treatment might be given in the field if proper back-up hospital facilities were available to treat serious reactions. There is a need for well documented information on the reactions which occur in some patients and on the results of treatment, particularly its effect on eye lesions.

¹ Crosskey, R. W. (1956) The distribution of Simulum damnosum Theobald in Northern Nigeria, Transactions of the Royal Society of Tropical Medicine and Hygiene, 50, 379.

Head nodules are commonly found in those children or young adults who develop serious ocular lesions. Nodectomy, particularly the excision of head nodules from children or young adults, may well reduce the incidence of blindness. I know of no published trials from Africa to support this suggestion and a controlled trial should be carried out. Medical auxiliaries might be trained to carry out nodectomy if in fact this proved of value.

4. XEROPHTHALMIA

Xerophthalmia is not widely recognized in northern Nigeria, vitamin A supplements are not given for routine prophylaxis, they are not normally available at dispensaries and they are not always given to affected children in hospital practice.

The following measures are recommended:

1. Improvement of the weaning diet. Although the importance as a preventative measure of supplements to pap in the weaning diet is recognized, there seems to be doubt as to the appropriate supplements to recommend to the Nigerian mother. Perhaps ABU University have suitable personnel (a paediatrician, nutritionist and anthropologist) who could cooperate in advising suitable and acceptable supplements. These would need to be suited to local conditions and would probably be different in different areas. Once sound advice was available it should be included in educational programmes and in propaganda at infant welfare clinics. This is of necessity a long-term project.
2. Routine prophylaxis by distribution of vitamin A supplements to children. This may prove a more immediate and effective way of combating xerophthalmia than the long-term measures of improving the diet. Capsules containing 200 IU vitamin A are available in bottles of 500 at a UNICEF price of US\$ 4.67 per bottle. The dose is one capsule per child and should not be repeated for six months. Medical auxiliaries, midwives and community nurses should be trained in their distribution and adequate supplies of the capsules made available to those who have been trained. In the first instance a controlled trial should be undertaken in a population which could be watched for the development of corneal lesions.
3. The prompt administration of vitamin A supplements by mouth, or if vomiting, by injection, to all child sufferers from pyrexia, gastrointestinal upset and other debilitating diseases should go a long way towards eliminating xerophthalmia even before the previous two recommendations can be brought into practice. It is suggested that medical officers be reminded of the value of this measure and that sufficient supplies of vitamin A be made available to them. Medical auxiliaries, midwives, community nurses and dispensary attendants should be trained to use the supplement and sufficient supplies be made available to those who have been trained.
4. Universal measles vaccination after the age of 11 months would be a valuable prophylactic measure. But there are many difficulties, e.g. maintenance of refrigeration during storage and transport, expense and post vaccination reactions resembling measles.
5. Education and public information programmes similar to those suggested for trachoma should be instituted in order to establish the above measures. They should be directed towards:
 - (a) mothers in infant welfare clinics;
 - (b) teachers in training colleges and through them children in schools;
 - (c) medical auxiliaries, midwives and nurses;
 - (d) medical students and ophthalmologists in training.

Suitable books, film strips and propaganda literature will be required for the programmes.

6. Supervision. Training alone is not enough. Regular supervision of rural health centres and dispensaries and maintenance of their supplies is essential. A general raising of standards throughout the region is required but this can only be achieved gradually. However, an intensive campaign, say in the ABU Project Area at Malumfashi, might demonstrate that this blinding disease of children can be eliminated.

B. Recommendations regarding staff

1. 'OPHTHALMOLOGISTS

Ophthalmologists will be the lynch-pin for any development of ophthalmic services. They are certain to be in short supply and, although every effort should be made to recruit and train them, there is no possibility, in the near future, of obtaining the services of 1000 ophthalmologists - the number which would be required to achieve the ratio of ophthalmologists to population which is found in a developed country.

In these circumstances one must ensure that the ophthalmologists available are deployed, assisted and equipped in such a way that they have the greatest possible impact on the control of eye disease and blindness. At the same time their work should be arranged so as to make it sufficiently congenial and rewarding to maintain morale and recruitment.

The following measures are suggested:

1. Wherever possible, auxiliary staff should be recruited and trained to undertake routine procedures and other tasks which do not necessarily require the expertise of an ophthalmologist. Examples of work which might be delegated are:

- (a) administration, particularly of rural units, by administrative or technical officers;
- (b) case finding by nurses or medical auxiliaries:
 - patients requiring surgery for cataract, trichiasis, onchocercal head nodules;
 - unilateral blind with a view to screening for glaucoma by an ophthalmologist;
 - active trachoma;
 - onchocerciasis by clinical signs and skin snip;
 - enumeration of technically blind and persons with impaired vision.
- (c) delivery of primary eye care in rural units, general hospitals and ophthalmic units by nurses and medical auxiliaries. They should be trained to diagnose and treat specific conditions such as conjunctivitis, trachoma, superficial corneal foreign bodies and to refer at the proper time patients with uveitis, glaucoma, cataract, etc.;
- (d) minor surgical procedures such as those for trichiasis, chalazion and removal of head nodules by nurses in hospital and medical auxiliaries in the field;
- (e) assistance with major surgical procedures by nurses;
- (f) refraction and dispensing of spectacles by opticians;
- (g) measuring visual acuity by nurses or medical auxiliaries;
- (h) tonometry and plotting visual fields by nurses or medical auxiliaries.

2. Ophthalmologists should concentrate on those specialized activities which will have the greatest effect in reducing eye diseases and blindness. Examples are:

- (a) Planning and where necessary directing programmes for the provision of eye care, e.g. mass trachoma campaign, cataract case finding and surgery, interdisciplinary approach to onchocerciasis, prophylaxis of xerophthalmia, primary eye care in ophthalmic units, peripheral general hospitals, rural health centres, and dispensaries.
- (b) Clinical decision-making directed to cure or prevention of blindness, e.g. final selection of patients for cataract surgery, diagnosis of glaucoma and selection of patients for surgery, diagnosis of onchocercal eye lesions and choice of patients for drug therapy.
- (c) Highly skilled surgical procedures such as cataract extraction, glaucoma surgery, corneal grafting. Whenever possible, surgery should be speeded up by using twin operating tables in the same theatre. A nurse would give the local anaesthetic and prepare the operation field for a patient on table A and then move to table B to complete an operation by inserting conjunctival sutures and dressing the wound. In the meantime, the surgeon would operate at table A, the third patient would be brought to table B and the nurse would anaesthetise and prepare the operation field for this patient in readiness for the surgeon.
- (d) Clinical assessment of the effectiveness of campaigns to control eye diseases such as trachoma, onchocerciasis and xerophthalmia.
- (e) Training, supervision and encouragement of appropriate junior staff required to carry out the work outlined in section (1) above.
- (f) Advising on the ophthalmic content of educational and public information programmes.
- (g) Ophthalmic research.

3. To further this programme ophthalmologists should have some training in the public health approach to eye problems (see under Fellowship in Tropical Ophthalmology).

4. In order to achieve a more even distribution of eye care ophthalmologists should be encouraged to do more rural work. It would not be unreasonable to suggest that on average every ophthalmologist should spend one day each week in rural areas but an ophthalmologist working single handed finds it difficult to leave his base. Rural work would be facilitated if there were at least two ophthalmologists at each peripheral centre - a consultant with a Fellowship and an ophthalmologist with a Diploma. The population as a whole might be best served if existing one man units were doubled up before new units were opened.

The Guinness Eye Centre has done some rural work in the past, despite very limited staff. They have recently acquired a larger staff and it is to be hoped that they will be able to lead the way in an orientation towards rural ophthalmology. Mr J. Sandford-Smith, Senior Lecturer, ABU, expressed an interest in this work.

2. GENERAL MEDICAL OFFICERS

A high proportion of total morbidity in northern Nigeria is due to eye disease and because of the shortage of ophthalmologists, it is important that medical officers play an appropriate part in the delivery of eye care. This should be recognized in their training at ABU which should be directed towards equipping them to fulfil the following functions:

- (a) diagnosis of eye conditions common in northern Nigeria, i.e. trachoma, trichiasis, cataract, onchocerciasis, xerophthalmia, glaucoma, uveitis, trauma, etc.;
- (b) prescribing medical therapy where appropriate;
- (c) carrying out minor surgical procedures;

- (d) referral of patients requiring major surgery or of difficult cases to an ophthalmologist;
- (e) advising on public health ophthalmology.

This syllabus is already largely covered. Its undoubted importance would be stressed, and its study encouraged, if a compulsory question on ophthalmology or even a paper, was included in the final examination. It might be argued that eye diseases are as important as say midwifery in a medical curriculum for northern Nigeria.

3. ENTOMOLOGISTS AND JUNIOR ENTOMOLOGISTS

Entomologists

Dr W. Gregory is, I understand, the only entomologist at present working on simulum assessment in northern Nigeria. I am informed that it would be virtually impossible to recruit more than one or two more fully trained entomologists at the present time. I therefore strongly recommend recruiting say five Nigerian candidates for university training overseas. This would be a four to five year course. Recruits should understand that they are being trained for employment in the field and it might be advisable for them to work in a rural area, say with Dr Gregory, for a few weeks or months to test their enthusiasm for this type of work before taking up the training. In the meantime, whilst Nigerian candidates are being trained, every effort should be made to recruit suitable expatriates so that the project is not delayed longer than necessary.

Junior entomologists

Because of the shortage of entomologists, junior entomologists working under the direction of university trained entomologists will play an important role in the simulum assessment surveys. A centre has been established at Bouaké, Ivory Coast, to train assistant entomologists for the Volta project. The training is at present in French but I was given to understand in Brazzaville that a course in English lasting about five months might be arranged for suitable candidates. Previous experience in trypanosomiasis or malaria control would be an advantage. I suggest that as soon as an entomologist has been recruited on a long-term contract, five students be sent to Bouaké for training.

Technical assistants will also be required.

Support

The best possible use should be made of the entomologists available. They must be provided with good housing, adequate transport, radio-communications and good administrative back-up so that they and their staff can apply their full energies to simulum assessment. The use of fixed wing aircraft speeds up the identification of breeding sites, helicopters are even more useful. It seems that simulum assessment can only be completed in reasonable time by the entomologists likely to be available if they are provided with aircraft.

4. ADMINISTRATIVE OFFICERS

Skilled administrators could relieve ophthalmologists of the routine work required for the efficient running of rural units. Their duties would include:

- (a) day to day direction and supervision of campaigns;
- (b) maintenance of supplies and distribution of drugs, dressings and equipment;
- (c) maintenance and direction of transport;
- (d) maintenance of communication with rural units by radio telephone where necessary;

- (e) arrangement of pay, leave, allowances, housing, etc.;
- (f) enumerating the population for rural surveys.

5. OPTICIANS

There is already a big demand for spectacles and with the rapid expansion of education, ophthalmic care and cataract surgery, the demand for these will increase.

In a country so short of ophthalmologists it is profligate to allow them to spend time testing for glasses. This work should be done by opticians. I consider there is, or soon will be, a need for an optician employed as part of the team in every eye unit and also for opticians practising privately. At present there is a serious shortage - e.g. the Nigerian optician at Kano S.I.M. Eye Hospital has recently left to take up a post at Benin and has not been replaced.

I understand that a training school for opticians has recently been established at Benin. An estimate should be made of the needs of northern Nigeria over say the next 10 years and enquiries made as to whether the Benin school can meet the needs. If not, energetic steps should be taken to recruit and train opticians, if necessary locally.

Patients who have had successful cataract surgery are usually still technically blind if they do not wear spectacles. Of the very few patients found in rural areas who had had cataract surgery only one was wearing spectacles and they had very scratched plastic lenses. I was told that cataract spectacles are supplied to patients routinely, perhaps they are embarrassed to wear them, or cannot accustom themselves to aphakic vision, or have merely broken the frames. Thought must be given to prescribing, dispensing and maintaining aphakic spectacles if patients are to obtain the full benefit from surgery.

6. NURSES

Ophthalmology is included in basic training and a postgraduate diploma course is run by the ABU Unit, Kaduna. Nurses, particularly those with an Ophthalmic Diploma, have a valuable role to play as part of the medical team and the present training appears adequate for this purpose.

7. MEDICAL AUXILIARIES

This grade is being expanded rapidly and it is planned to provide a network of staff who are sufficiently mobile to provide primary care to the entire rural population. These auxiliaries will be responsible for the delivery of eye care to the majority of the population. It is vital that they have a good practical knowledge of common eye diseases and their treatment, and that they are able to identify those patients who should be referred to a doctor. To this end the syllabus of ophthalmic training should include:

- (a) recording of visual acuity in each eye separately with an illiterate or Snellens chart;
- (b) use of binocular loupe and focal illumination;
- (c) common diseases of the eyelids and their medical treatment. Eversion of eyelids;
- (d) conjunctivitis and its treatment;
- (e) trachoma;
- (f) corneal lesions and staining with fluorescein strips;
- (g) removal of superficial conjunctival and corneal foreign bodies. Referral of penetrating injuries;
- (h) recognition of ciliary injection, iridocyclitis and acute glaucoma and referral;

- (i) diagnosis of cataract and referral;
- (j) examining for nodules and taking skin snips for onchocerciasis;
- (k) xerophthalmia, its prophylaxis, recognition and treatment.

Advanced training for work with special eye units:

- (a) standard surgical procedure for trichiasis;
- (b) nodulectomy;
- (c) incision and curettage of chalazia.

8. LAY ASSISTANTS

These will be needed for the trachoma campaign (see page 5).

C. Development of ABU Ophthalmic Unit

The future function of the ABU Ophthalmic Unit is seen under the following heads:

1. Ophthalmic care within North Central State, having due regard to the needs of the rural population and maintaining the standards of excellence expected of a university department both at the base hospital and in the field.
2. Applied research into ophthalmic problems throughout the northern region.
3. Teaching: undergraduate and postgraduate doctors; undergraduate and postgraduate nurses; and practical tuition to medical auxiliaries.
4. Initiation of an interdisciplinary approach to such problems as:
 - (a) suitable dietary supplements for the prevention of xerophthalmia in children (see page 9);
 - (b) teaching and propaganda aids to combat eye diseases such as trachoma, xerophthalmia and cataract;
 - (c) control of onchocerciasis.
5. Coordinating body for programmes aimed at the prevention of blindness.

The following special projects are envisaged:

1. Regular and systematic visiting of rural areas throughout the state by as many of the staff as feasible. This should be supported by an administrative officer responsible for arranging the visits in advance and maintaining supplies and transport including that of patients to and from Kaduna.
2. Liaison with the mass trachoma campaign.
3. Cooperation with paediatricians in a trial of vitamin A supplements in the prophylaxis of xerophthalmia.
4. Establishment of drug trials and nodulectomy trial in an area heavily infected with onchocerciasis - Hawal Valley, in cooperation with the CBM Hospital there.
5. An investigation into primary glaucoma.
6. Establishment of a Postgraduate Fellowship in Tropical Ophthalmology dealt with separately below.

7. Recruitment of sufficient staff to undertake these projects.
8. Installation of direct radio-telephone links such as those used by missionary societies in northern Nigeria, firstly between the Guinness Eye Hospital, Kaduna and the ABU Hospital, Zaria and also if possible between them and the main rural projects at say Malumfashi (xerophthalmia), Garki (trachoma) and Garkida (onchocerciasis). These links should overcome the frustrations of not receiving laboratory reports and of travelling hundreds of miles to make a simple enquiry. They would also facilitate the transfer of patients and supply of drugs, etc. in emergency.

Postgraduate Fellowship in Rural Ophthalmology

The need:

1. More than half the population of northern Nigeria are suffering from eye disease and it is estimated that there are half a million blind persons.
2. Approximately half the blindness in Nigeria is due to diseases not endemic in Europe.
3. There are few ophthalmologists. A marked improvement can be hoped for but there is no possibility of the ratio of ophthalmologists to eye patients reaching European levels in the near future. Therefore, any attempt to graft European methods of hospital ophthalmology without adaptation onto the Nigerian situation is doomed to fail the rural population. This has been all too clearly revealed by the present investigation. Only by applying the techniques of public health ophthalmology may eye disease and blindness be controlled to the ultimate benefit of the population as a whole.¹

Nevertheless, a basic training in ophthalmic science in Europe and the widening of horizons which a course of training overseas must encourage are valuable assets.

I would advocate the following programme for training ophthalmologists with a view to service in northern Nigeria:

1. An ophthalmic senior house surgeon appointment in Nigeria. Part of the training should be an attachment to a rural unit.
2. A one year postgraduate course in ophthalmology overseas leading to a Diploma in Ophthalmology. Some students might take up posts as junior ophthalmologists at this stage. Others would continue to complete the training for a consultant post.
3. A three year course for a Fellowship in Tropical Ophthalmology provided by ABU leading to consultant status.

The Fellowship course

The ABU Eye Unit, Kaduna, is ideally placed to provide such a course. It serves a densely populated part of Africa where tropical eye diseases are a serious problem and a network of good trunk roads is being developed. It is already well established as a clinical centre and if its rural work is developed along the lines indicated the project could be founded on a firm base.

The course should be directed towards providing a comprehensive ophthalmic training whilst emphasizing the main ophthalmic problems in Nigeria, i.e. trachoma, senile cataract, onchocerciasis, xerophthalmia and glaucoma. A high standard of clinical and surgical excellence should be maintained whilst teaching a community approach to the promotion of eye health.

¹ The prevention of blindness. Report of a WHO Study Group, World Health Organization Technical Report Series (1973), No. 518.

Students would work as registrars and senior registrars in the base unit at Kaduna, participating in its clinical, surgical, laboratory and research departments. They would also be seconded to work with the various rural project teams. Epidemiological studies related to the eye problems of tropical Africa would be included in the programme.

This course would be unique and should meet an international need. Once established it might provide training for students from other West African and possibly East and Central African countries.

Priorities

Future development is limited more by availability of suitable technical staff than by shortage of financial resources. Priority should, therefore, be given to recommendations which can be carried out by redeployment of present staff and to the training of key personnel.

I. Schemes which might be carried out by redeployment of present technical staff

1. Pilot trachoma mass treatment project. Dr H. Rössler, WHO consultant, is available to initiate this. A local ophthalmologist or public health medical officer should be seconded to work with Dr Rössler with a view to taking over the eventual supervision of the trachoma control project. If a suitable candidate is not available a medical officer might be seconded to gain experience of trachoma under Dr Rössler. An administrative officer should also be appointed to the project as soon as possible.
2. Liaison with the Education Department and educational publishers with a view to inclusion of ocular hygiene and prevention of blindness in the syllabus of teacher training colleges and primary schools. One of the staff of ABU Eye Unit should be asked to initiate discussions. He might seek advice on ophthalmic health education from WHO but the syllabus evolved and the texts produced should be suited to local problems and local conditions.
3. Recruitment of suitable students for university training as entomologists in Europe.
4. Control trial of vitamin A capsule supplements administered every six months to children with a view to establishing their value in the prevention of the corneal lesions of childhood. It is hoped that this may be planned and undertaken by an ABU ophthalmologist in cooperation with a paediatrician in an area where the child population can be, or is already, enumerated. The Malumfashi Project Area where Finnish paediatricians are already working would be ideal if a large enough population were enumerated, perhaps in an adjacent district. It should not be exposed to other therapeutic or public health measures which might confuse the result.
5. Ensuring adequate, regular supplies of essential ophthalmic drugs to all rural health centres and dispensaries. ABU Eye Unit Staff could advise the Federal and/or State Governments on suitable drugs. The method by which these drugs are supplied must be reviewed and a scheme devised which avoids the present shortages. This is not primarily an ophthalmic problem but rural ophthalmic care cannot flourish until the situation is remedied. An appeal might be made to UNICEF for vitamin A supplements, tetracycline drops and chloramphenicol ointment to be supplied direct by ABU for special control projects.
6. Inclusion of a chapter on eye diseases, their prevention and their treatment in a text book which, I understand, is being prepared for the use of medical auxiliaries by Dr Patel of the Kaduna Training School. Also visual aids on eye disease should be prepared for their training. Outside help, possibly through WHO might be sought with this work.
7. Raising the standard of equipment in all State hospital eye units to an acceptable minimum level and providing an adequate number of eye beds (a minimum of 20 per ophthalmologist is suggested).

II. Schemes for which recruitment of additional technical staff is required

8. Fostering of rural ophthalmic services by all eye units. The following recommendations are made to further this end:

(a) Appointment of a rural ophthalmologist to the ABU staff supported by an administrative officer. These might be WHO appointments in view of the key importance both in coordinating public health ophthalmology and in training staff. The rural ophthalmologist should be of consultant status and trained in epidemiology (a D.P.H. would be valuable, a D.T.M.&H. might suffice). He would be responsible for:

(i) maintaining the rural projects suggested in cooperation with existing staff and maintaining liaison with the trachoma project - probably assuming responsibility for it when Dr Rössler leaves;

(ii) training senior house surgeons in rural ophthalmology.

He would be based in Kaduna and accept some clinical responsibilities there, thus allowing the present staff to increase their commitment to rural work.

(b) Appointment of a second ophthalmologist to each existing Government eye unit before opening any new units.

(c) Appointment of a third ophthalmologist to the S.I.M. Eye Hospital, Kano. He would be mainly responsible for rural work but would also have some clinical responsibilities at the base hospital and would thus allow the present staff to do some rural work. I understand that the Mission would welcome such an appointment; that they might be able to find a suitable recruit but that they would not themselves be able to provide finance. In view of the importance of involving this highly efficient hospital in rural work, an approach might be made through the International Agency for the Prevention of Blindness for financial support.

(d) Provision of adequate transport for rural work to all units able to undertake this. This would be used to carry staff and supplies. Also to convey patients to and from hospital where necessary. The International Agency for the Prevention of Blindness might be prepared to help with vehicles - long wheel base Landrovers would be suitable.

(e) Radio-communication system between ABU Kaduna, ABU Zaria and rural projects. The International Agency for the Prevention of Blindness might be asked to sponsor this.

(f) Provision of cheap aphakic spectacles for distribution free or at a minimal charge to needy patients. The International Agency for the Prevention of Blindness might be approached for help.

9. Recruitment of trained entomologists. It is hoped that the Nigerian Government will be able to retain the services of Dr W. Gregory, who is at present serving as a VSO, on a more permanent basis. Additional entomologists will be needed for the simulum assessment surveys. It is urgent to start this work because no control can commence until the assessment has been made. In view of the difficulty in obtaining recruits, WHO or the International Agency for the Prevention of Blindness might be approached to enquire whether they might recruit an entomologist. The Nigerian Government fully appreciates the importance of this work and would no doubt be prepared to meet the cost.

10. Once a staff of entomologists is assured, recruits might be sent to Bouaké for training as junior entomologists.

11. Recruitment of senior house surgeons.

Subsequent developments

12. Appointment of additional staff to ABU with a view to extending rural ophthalmic services and establishing the training course for the Fellowship in Tropical Ophthalmology. These appointments might include:
 - (a) trachomatologist;
 - (b) ophthalmologist with special interest in onchocerciasis;
 - (c) surgeon with a special interest in intra-ocular surgery (cataract, glaucoma).
13. Extension of the Volta River Onchocerciasis Control Programme to Nigeria. This would be supported by International Aid.
14. Establishment of an opticians' training school if this proves necessary.

ACKNOWLEDGEMENT

I wish to thank the many Government, ABU University, Medical Missionary and WHO staff who assisted me in this project.

Data already available in the literature

Stock, F. E. (1946, British Medical Journal, 1525)

Report of a survey in Yelwa Town (Maiduguri). He stated that the Native Authority found an incidence of 1.4% blindness "but it is certain that this is an under-estimation, and the correct figure is probably between 2 and 2.5 per cent.". Out of 254 blind persons, 103 were recorded as due to conjunctivitis and a further 103 due to smallpox. Trachoma and onchocerciasis were not recorded.

Budden, F. H. (1952, British Medical Journal, 1, 1248)

An analysis of 144 persons unable to count fingers at 2 metres seen at surveys in Bornu, Bauchi, Adamawa, Zaria and Plateau Provinces. The commonest causes of blindness found were:

Trachoma - 46 cases	(32%)
Onchocerciasis - 39 cases	(27%)
Senile cataract - 20 cases (of which 2 had been couched)	(14%)
Leucoma, phthisis and staphyloma attributed by the patient to local eye disease, "bakwandoro" (measles etc.) or smallpox - 19 cases	(13%)
Glaucoma - 5 cases	(3%)

It was commented that although onchocerciasis was the second commonest cause of blindness in the sample, it was probably less important in the country as a whole.

Budden, F. H. (1956, Transactions of the Royal Society of Tropical Medicine and Hygiene, 50, 366)

A detailed account of the distribution of onchocerciasis in northern Nigeria. It was estimated that it was the cause of blindness in 20 000 persons.

Thomson, I. G. (1956, Journal of Tropical Medicine & Hygiene, 59, 155-161)

A survey of 2907 persons (84% of the entire population) in Kankiya District showed 37 (1.3%) persons with visual acuity less than 3/60. The causes of blindness were:

Leucoma, staphyloma and phthisis - 21	57%
Trachoma 9	24%
Cataract 3	8%
Glaucoma 3	8%
Optic atrophy 1	3%

The writer found evidence of xerophthalmia in 21% of persons examined and concluded that vitamin A deficiency must predispose to the high incidence of eye disabilities including blindness.

Appendix I

Rodger, F. C. (1959, Blindness in West Africa, HK Lewis, London)

An investigation of blindness in a limited number of Provinces of northern Nigeria. The standard of blindness used was inability to count fingers at 1 metre. The prevalence of blindness found was 0.8% and the commonest causes of blindness in 2330 blind persons were:

Trachoma	713	31%
Cataract	423	18%
Onchocerciasis	257	11%
Unknown origin (most were phthisis and corneal ulcers)	246	11%
Syphilis	166	7%
Smallpox	163	7%

A search of the literature made in Geneva and enquiries through the Federal Ministry of Health, Lagos, have not revealed any subsequent publication. However, unpublished data collected by F. H. Budden between 1951 and 1959 are in preparation.

Surveys conducted during the present visit

In the limited time available, three weeks in northern Nigeria, it was not feasible to conduct exhaustive surveys to find the prevalence and causes of blindness.

Method

Surveys were conducted in three areas where an accurate census of the population was already available. In each area a number of villages were selected for survey.

In each area the District Head readily gave his consent to the survey and notified the villages concerned at least 24 hours prior to my visit. They were asked to collect blind persons, those with impaired vision and those with serious eye disease for examination. Visual acuity was recorded using a Landolt's ring chart. All patients were examined using loupe, focal illumination, a slit lamp run off a 12 volt battery and an electric ophthalmoscope. Pupils were dilated with "Mydriacyl" when indicated. A very few blind persons were too infirm to attend for examination and were seen in their huts without a slit lamp.

The areas were as follows (see Map 1):

1. Malumfashi District. Mr A. Bradley had enumerated the population in connexion with an ABU Research Project, immediately prior to my visit. Unfortunately my survey in this area had to be curtailed through lack of transport and the enumeration of blind persons was completed by Mr Bradley shortly after my departure (see Table 2). I therefore only examined clinically 56 of the 169 blind persons found by Mr Bradley.
2. Garki District. The population had been enumerated in defined areas by the WHO Malaria Control Unit. I visited most villages in the areas shown in Table 3 and Map 2. In this area I enumerated the blind people myself and all 51 were examined clinically.
3. Hawal Valley. In 1971, Mr Bradley enumerated the population and blind persons living in the villages shown in Table 4 and Map 3. I examined the entire population in 1959 and selected patients with impaired vision in 1973 and 1974. I was able to determine the cause of blindness in 85 of the 91 blind persons found by Mr Bradley.

Findings and discussion

Findings are recorded in Tables 1 to 5.

The standard of blindness used was inability to read 3/60.¹

Except in the Hawal Valley where I had tested the visual acuity of the whole population at the previous survey in 1959, we relied on persons with impaired vision presenting or being identified by the Ward or compound head. Because of lack of transport my survey in Malumfashi District had to be curtailed and additional blind people were enumerated by Mr Bradley after my departure. Some persons not obviously blind may have been missed. Another possible source of error was that at the time of my visit (November) it is customary for blind beggars to congregate in the large towns. I was told of a few people who had left the villages surveyed for this purpose. They are likely to have been persons with disfiguring eye disease. For these two reasons the prevalence rates for blindness are liable to be under-estimates, particularly in Malumfashi District, but the error is not thought to be large.

¹ The prevention of blindness. Report of a WHO Study Group, World Health Organization Technical Report Series, (1973), No. 518.

Appendix II

TABLE 1. BLINDNESS RATES FOUND IN THREE DISTRICTS
OF NORTHERN NIGERIA

	Malumfashi District	Garki District	Hawal Valley
Population investigated	47 880	3 517	1 624
Number of blind persons	169*	51	91
Blindness rate %	0.35*	1.45	5.60

* These figures are rather lower than anticipated, see
comments under Findings and Discussion in text.

TABLE 2. MALUMFASHI DISTRICT - POPULATION
AND PREVALENCE OF BLINDNESS

Village	Hamlet	Population	No. blind	Blindness rate %
Mahuta	Mahuta gari	3 125	9	0.29
	Rawaiya	1 150	3	0.26
	Sabon Layin Nassarawa	933	1	0.11
	Kagara	1 750	9	0.51
	Sabon Layin Suran	1 641	4	0.24
	Ungwan Kyanbo	670	3	0.45
	Dan Kwaro	2 366	13	0.55
Mahuta		11 635	42	0.36
Dantatture	Dantatture gari	1 031	5	0.48
	Daranfada	231	0	0.00
	Jargaba	1 035	2	0.19
	Mallamawa	859	6	0.70
	Jange	1 198	4	0.33
	Rafin Sako	616	0	0.00
	Ungwan Jali	140	0	0.00
	Durumai	545	3	0.55
	Takawa	831	2	0.24
	Dankanjiba	2 024	8	0.40
Dantatture		8 509	30	0.35
Gamzago	Gamzago gari	2 853	5	0.18
	Bagari	2 117	10	0.47
	Butawa	386	0	0.00
	Ungwan Barde	836	6	0.72
	Mallamawa	1 021	4	0.39
	Kadadani	643	3	0.47
	Badawa	1 102	4	0.36
	Barakai	617	4	0.65
	Kwari	464	4	0.86
	Zamfarawa	883	8	0.91
Gamzago		10 922	48	0.44
Yar Talata	Yar Talata gari	817	2	0.24
	Zango	1 146	6	0.52
	Kurmi	951	5	0.52
	Maihanci	1 042	1	0.10
Yar Talata		3 956	14	0.35

Appendix IITABLE 2. MALUMFASHI DISTRICT - POPULATION
AND PREVALENCE OF BLINDNESS (continued)

Village	Hamlet	Population	No. blind	Blindness rate %
Ruwan Sanyi	R/Sanyi (inc. S/Gari)	5 557	13	0.23
	Kurmin Sarki	254	1	0.39
	Dandanbaka	43	1	2.33
	Ungwan Dilo	93	1	1.08
	Ungwan Malam Alu	137	1	0.73
	Maijangali	238	1	0.42
Ruwan Sanyi		6 322	18	0.28
Kuringafa	Kuringafa	1 420	2	0.14
	Walawa	2 467	5	0.20
	Tapkinjage	1 611	3	0.19
	Jange	1 038	7	0.67
Kuringafa		6 536	17	0.26
TOTAL		47 880	169	0.35

Appendix II

TABLE 3. GARKI DISTRICT -
POPULATION AND PREVALENCE OF BLINDNESS

Malaria treatment area	Village	Population	No. of blind persons	Blindness rate %
08	Jaya	478	3	0.63
	Gunzara	233	2	0.86
03	Sugungum	576	5	0.87
	*Karama	209	*	*
	Bataka She	195	3	1.54
	*Daurawa	170	*	*
01	Tafinsale	314	2	0.64
	Kwaru	153	4	2.61
	Baribari	143	1	0.70
07	Nasakar	179	3	1.68
	Kargo Kudu	220	2	0.91
	*B. Sabara	132	*	*
05	Rafin Marke	313	10	3.19
	*Kukar Maikiya	413	*	*
	Kawari	202	7	3.47
02	*Ajura	379	*	*
	Nabanawa	511	9	1.76
Total for villages visited in 1974		3 517	51	1.45

Population: Figures supplied by WHO Malaria unit from their Survey No. 16 of November/December 1973. NB: Their demographic base-line report 112 - 0172 states "there was no significant variation between the surveys" and it is therefore assumed that the population in December 1974 was similar.

Number blind: Persons presenting at 1974 survey.

* Villages not visited in 1974.

Appendix IITABLE 4. HAWAL VALLEY -
POPULATION AND PREVALENCE OF BLINDNESS

	Population	No. blind	Blindness rate %
1. Tsakasimta	168	8	4.76
2. Gangaran	97	6	6.19
3. Rabasu	26	7	26.92
4. Civirmobulu	58	4	6.90
5. Pyelambirni	516	26	5.04
6. Bwala-Pakla	140	7	5.00
7. Garu	103	7	6.80
8a. Hng Bura	195	11	5.64
8b. Hng Cibok	63	2	3.17
8. Hng	258	13	5.04
TOTAL	1 624	91	5.60

Appendix II

TABLE 5. THE CAUSES OF BLINDNESS FOUND
IN THREE DISTRICTS OF NORTHERN NIGERIA

Cause of blindness	Malumfashi District		Garki District		Hawal Valley	
	No. of eyes	%	No. of eyes	%	No. of eyes	%
"Senile" cataract	48	43	42	41	20	12
Trachoma	14	13	20	20	-	-
Corneal lesions and phthisis - onset in childhood	16	14	16	16	6	4
Onchocerciasis	-	-	-	-	124	75
Uveitis - causes not known	11	10	9	9	2	1
Glaucoma - primary	9	8	6	6	8	5
Corneal lesions and phthisis - onset in adults	6	5	4	4	4	2
Smallpox	2	2	2	2	2	1
Congenital cataract	4	4	-	-	-	-
Congenital glaucoma	-	-	-	-	2	1
Trauma	1	1	1	1	-	-
Band-degeneration	-	-	-	-	2	1
Other and unknown	1	1	2	2	-	-
TOTAL	112		102		170	

APPENDIX III

Basic equipment for Ophthalmic Units

Outpatients Department

.This should be on the ground floor with no steps. There should be a fully equipped consulting area for each doctor or optician working in the unit.

Each area should be designed to include:

7 metre working length to allow vision testing,
blackout facilities, and air conditioning.
6 power points per person.

A similar working area should be provided for Senior Nurses doing the preliminary selection of cases but dark-room facilities are not essential. Separate treatment and minor operation areas are required.

Each working area should be equipped with:

Roller Test Type with spotlight
Illiterate E (or handolt C) test letters on separate cards each 5 inches square. They might be printed locally (or drawn locally with Indian ink on white card).
Near vision tests in English, Hausa, Arabic, also reduced Suellen chart with letters and illiterate E (? locally printed)
Binocular loupes

In addition each surgeon requires:

Slit lamp complete with table
Adjustable stool and adjustable chair
Applanation tonometer
Gonioscopy lens
Direct Ophthalmoscope
Monocular loupe x 10
Small set of trial lenses in case (larger set of say 130 lenses if optician not available to refract)
Skeoch trial frame
Maddox wing
Maddox rod

In addition each optician requires:

Focimeter*
Set of say 130 trial lenses in case
Skeoch trial frame
Foster Triple lens test 0.50 dioptre*
Maddox wing
Maddox rod

* These items will be required by the surgeon if no optician is available.

Appendix III

Additional items to be shared by the surgeons:

Triple mirror contact lens
Perimeter
2 metre Bjerrum Screen complete with targets
Placido's Disc
Ishihara Test

Equipment and instruments of OPD theatre

Stainless steel undine	1
Bard Parker handle No. 3	2
Chalazion clamp	2
" currettes (different sizes)	4
Silver lachrymal cannulas	4
Lacrymal punctum dilators	2
Apilation forceps	2
Plain conjunctival forceps	2
Jayles forceps	2
Lid speculum with lash guard	1
Wire lid retractors, pair	1
Needle holder, Castroviejo	1
Foreign body needle	2
Schiots Tonometer	1

Equipment and instruments for Inpatient theatre

Dunhill's Mosquito forceps:	straight	20
" " "	curved	10
Spencer Wells " "	straight	10
Forceps Jayles, toothed		6
Conjunctival non-toothed		6
Blocked iris, Barraquer		4
Epilation		3
Iris non-toothed		4
Intracapsular, Duthie's		2
" Arruga		2
Tilley-Hinkley, Nasal		1
Scissors: Conjunctival straight,		
blunt		4
Stravismus curved, blunt		4
"Iris" straight, sharp		
points		4
Vanna's spring action		3
De Wecker's iris sharp		
points		3
Springaction, incision		
enlarging, Castroviejo,		
double curved, left and		
right		2
Werb's posterior flap DCR		1
Excision, extra strong		1
Cautery, Wordworth's with copper		
bath and stainless steel end		2

Razor blade holder	2
Needle holders: Castroviejo with catch	4
Barraquer fine jaws	3
Needle, cataract, Bowman's	2
Bard Parker handle No. 3	2
Knife, Graefe cataract	3
" Smith's back pointed cataract	3
" Capsulotomy Ziegler, curved blade	2
Speculum lid with lash guard, right and left	4
Scoop, evisceration	1
Suture clips "Bulldog"	6
Towel " Cross action 3-1/2 inch	6
Iris repositors	4
Hook, conjunctival	4
" squint	4
Cannulas, lachrymal, silver	8 (different sizes)
" air	24
Needles retrobulbar	36
Keratome, angles medium	2
Undine, stainless steel	1
Probes, lachrymal, Bowman's set of 4	1
Canaliculus dilator, Nettleships	2
Diatheray depressor, Guist's	1
Retractors, Rolletts Lachrymal sac	2
Lachrymal sac spoon and dissector	1
" " rugine, Rolletts	1
Periosteal elevator, Traquair	1
Double-ended dissector, Stallard	1
Lachrymal sac self-retaining retractor	1
*Nasal sucker, fine	1
*Nasal specucum	1
*Upper cutting sphenoidal punch forceps (large, medium and small)	3
Snare enucleation with wire	1
Catholysis apparatus (for electrolysis of eye lashes for use from A.C. mains complete with handle, needles and "wet pad")	1
Cautery electric with transformer for A.C. mains, for ophthalmic use with 4 fine straight pointed electrode ends	1
Cryo apparatus - simple such as Fisons with straight head for cataract extraction and curved head for retinal work	

* May be borrowed from E.N.T. Department.

Appendix III

Sterilizer boxes complete with instrument racks, Philps	10
Adjustable stool for surgeon and assistant	2

Expensive items requiring maintenance and which may not be needed in every unit

Operating microscope on floor stand
Simple cryo-apparatus e.g. Fisons with heads for
cataract and retinal surgery
Small diathermy apparatus, e.g. Manchester giant
magnet

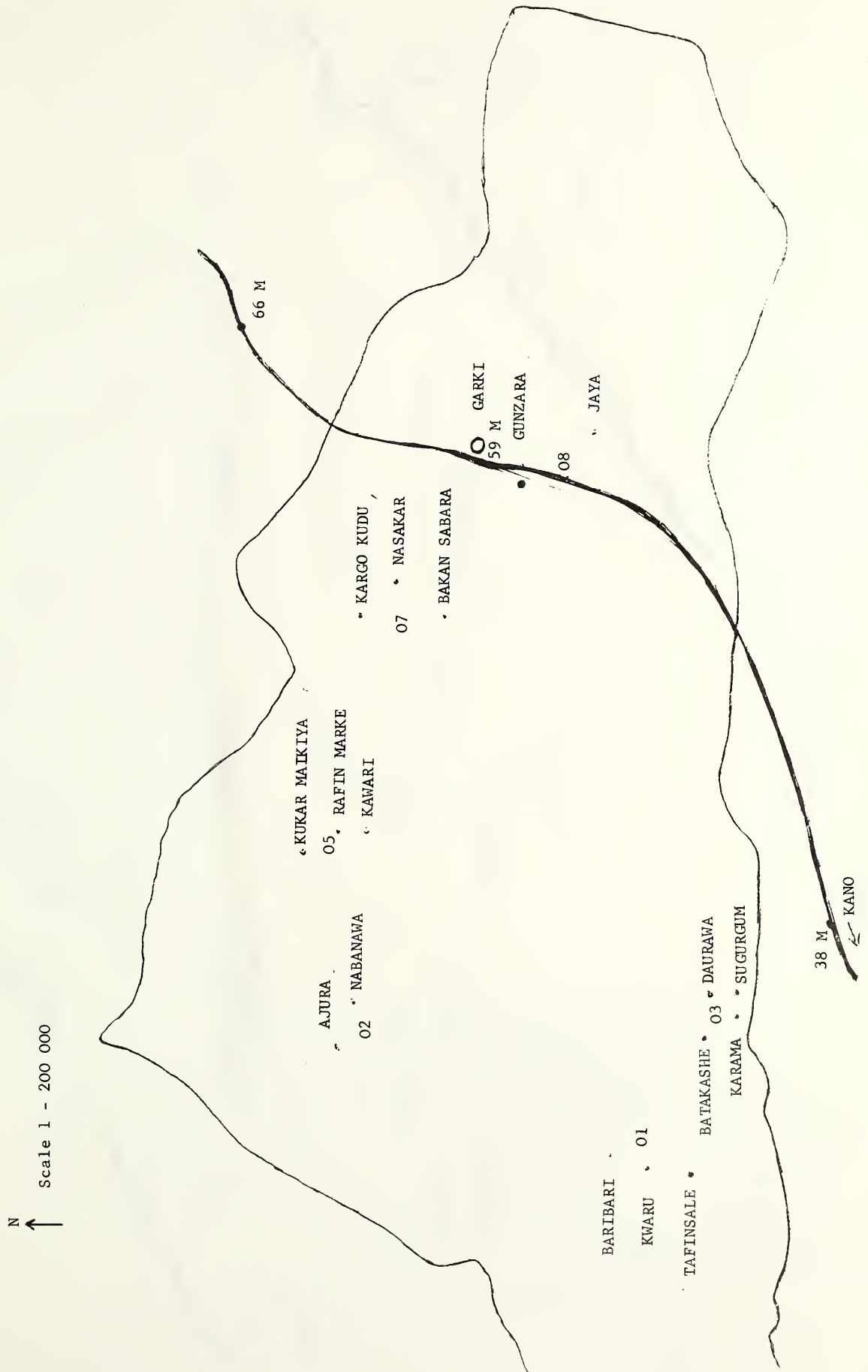
Initial supplies

Maddox cataract needles	1 dozen
Supramid thread	1 reel
Silicone tapes, assorted widths	1/2 dozen
" plombs " "	1/2 "
Bodkins O'Donoghues	6
Box of assorted artificial eyes with dark irides	
Shells for conjunctival sac - selection of sizes right and left	12
Selection of ophthalmic sutures	

MAP 1



MAP 2. GARKI DISTRICT



MAP 3. HAWAL VALLEY



MAP 4. MALUMFASHI DISTRICT





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NIGERIA.
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